

Non-wavelength selective fibre optic branching devices —

Part 1: Generic specification

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British Standard

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English version

Non-wavelength-selective fibre optic branching devices
Part 1: Generic specification
(IEC 60875-1:2000)

Dispositifs de couplage pour fibres
optiques ne dépendant pas
de la longueur d'onde
Partie 1: Spécification générique
(CEI 60875-1:2000)

Lichtwellenleiter-Verzweiger
(Wellenlängenunabhängig)
Teil 1: Fachgrundspezifikation
(IEC 60875-1:2000)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 86B/1361/FDIS, future edition 4 of IEC 60875-1, prepared by SC 86B, Fibre optic interconnecting devices and passive components, of IEC TC 86, Fibre optics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60875-1 on 2000-11-01.

This European Standard supersedes EN 60875-1:1998.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2001-08-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2003-11-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annex A is informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60875-1:2000 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068	NOTE: Harmonized in the EN 60068 and HD 323 series (not modified).
IEC 60874	NOTE: Partly harmonized as EN 60874 series.
IEC 61753	NOTE: Partly harmonized as EN 61753 series.
IEC 61754-2	NOTE: Harmonized as EN 61754-2:1997 (not modified).
IEC 61754-4	NOTE: Harmonized as EN 61754-4:1997 (not modified).
IEC 61754-13	NOTE: Harmonized as EN 61574-13:1999 (not modified).
IEC 62005	NOTE: Harmonized as EN 62005 series.

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INTRODUCTION

This part of IEC 60875 is divided into three clauses:

- 1 General
- 2 Requirements
- 3 Quality assessment procedures

The first clause contains general information pertaining to this generic specification.

The second clause contains all the requirements to be met by branching devices covered by this standard. These include classification, IEC specification system, documentation, materials, workmanship, quality, performance, identification, and packaging.

The third clause contains those procedures which need to be followed for proper quality assessment of products as covered by this standard.

NOTE Test and measurement procedures are described in IEC 61300-1, IEC 61300-2 and IEC 61300-3.

NON-WAVELENGTH-SELECTIVE FIBRE OPTIC BRANCHING DEVICES –

Part 1: Generic specification

1 General

1.1 Scope

This part of IEC 60875 applies to non-wavelength-selective fibre optic branching devices, all exhibiting the following features:

- they are passive, in that they contain no optoelectronic or other transducing elements;
- they have three or more ports for the entry and/or exit of optical power, and share optical power among these ports in a predetermined fashion;
- the ports are optical fibres, or optical fibre connectors.

This standard establishes uniform requirements for the following:

- branching devices requirements;
- quality assessment procedures.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60875. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60875 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC QC 001001:1998, *IEC Quality Assessment System for Electronic Components (IECQ) – Basic Rules*

IEC QC 001002 (all parts), *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of Procedure*

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050(731):1991, *International Electrotechnical Vocabulary (IEV) – Chapter 731: Optical fibre communication*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

IEC 60617 (all parts), *Graphical symbols for diagrams*

IEC 60695-2-2:1991, *Fire hazard testing – Part 2: Test methods – Section 2: Needle-flame test*

IEC 60825 (all parts), *Safety of laser products*

IEC 60875-1-1:1996, *Fibre optic branching devices – Part 1-1: Blank detail specification*

IEC 61300-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 1: General and guidance*

IEC 61300-2 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2: Tests*

IEC 61300-3 (all parts), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3: Examinations and measurements*

IEC 61748: *Manufacturing line approval (QML) for MCM*¹⁾

IEC Guide 102:1996, *Electronic components – Specification structures for quality assessment (Qualification approval and capability approval)*

ISO 129:1985, *Technical drawings – Dimensioning – General principles, definitions, methods of execution and special indications*

ISO 286-1:1988, *ISO system of limits and fits – Part 1: Bases of tolerances, deviations and fits*

ISO 370:1975, *Toleranced dimensions – Conversion from inches into millimetres and vice versa*

ISO/DIS 1101, *Geometrical Product Specifications (GPS) – Geometrical tolerancing – Generalities, definitions, symbols, indication on drawings*¹⁾

ISO 8601:1988, *Data elements and interchange formats – Information interchange – Representation of dates and times*

1.3 Definitions

For the purpose of this part of IEC 60875, the definitions given in IEC 60050(731) apply, together with the following definitions:

1.3.1

port

optical or optical connector attached to a passive component for the entry (input port) and/or exit (output port) of the optical power

1.3.2

non-wavelength-selective branching device

passive component possessing three or more ports which operates over a specified range of wavelengths and shares the optical power coming into an input port among its output ports in a predetermined fashion, without any amplification, switching, or other active modulation

1.3.3

optic pigtail

short length of jumper or cable forming an optical port for an optic component

¹⁾ To be published.

1.3.4 splitter

term frequently used as a synonym for a non-wavelength-selective branching device

NOTE The term is also used to define a structure for transferring optical power between two fibres or between an active device and a fibre.

1.3.5 balanced splitter

splitter designed and intended to produce equal optical power at the output ports

1.3.6 unbalanced splitter

splitter designed and intended to produce different optical power at the output ports

1.3.7 transfer matrix

optical properties of a non-wavelength-selective optic branching device can be defined in terms of an $n \times n$ matrix of coefficients, n being the number of ports, with the coefficients representing the fractional optical power transferred between designated ports

In general, the transfer matrix T is as follows:

$$T = \begin{bmatrix} t_{11} & t_{12} & \cdot & \cdot & \cdot & t_{1n} \\ t_{21} & & & & & \\ \cdot & & & & & \\ \cdot & & & t_{ij} & & \\ \cdot & & & & & \\ t_{n1} & & & & & t_{nn} \end{bmatrix}$$

where

t_{ij} is the ratio of the optical power P_{ij} transferred out of port j with respect to input power P_i into port i , that is:

$$t_{ij} = P_{ij}/P_i$$

The transfer matrix is used to classify the different types of non-wavelength-selective branching devices which are specified in this generic specification.

In a non-wavelength-selective branching device, the coefficients t_{ij} may be a function of the input wavelength, input polarization or modal power distribution. The values of these parameters are provided in the detail specification, when necessary.

Single-mode, non-wavelength-selective branching devices may operate in a coherent fashion with respect to multiple inputs. Consequently, the transfer coefficients may be affected by the relative phase and intensity of simultaneous coherent optical power inputs at two or more ports.

1.3.8 transfer coefficient

element t_{ij} of the transfer matrix

1.3.9

logarithmic transfer matrix

in general, the logarithmic transfer matrix is as follows:

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdot & \cdot & \cdot & a_{1n} \\ a_{21} & & & & & \\ \cdot & & & & & \\ \cdot & & & a_{ij} & & \\ \cdot & & & & & \\ a_{n1} & & & & & a_{nn} \end{bmatrix}$$

where

a_{ij} is the optical power reduction in decibels out of port j with unit power into port i , that is:

$$a_{ij} = -10 \log t_{ij}$$

where t_{ij} is the transfer matrix coefficient.

1.3.10

attenuation

element, a_{ij} (where $i \neq j$), of the logarithmic transfer matrix; reduction in optical power between an input and output port of a passive component expressed in decibels and defined as

$$a = -10 \log (P_1/P_0)$$

where

P_0 is the optical power launched into the input port;

P_1 is the optical power received from the output port.

1.3.11

return loss

element, a_{ij} (where $i = j$), of the logarithmic transfer matrix; fraction of input power that is returned from the input port of a passive component and defined as

$$RL = -10 \log (P_1/P_0)$$

where

P_0 is the optical power launched into the input port;

P_1 is the optical power received back from the same port.

1.3.12

conducting ports

two ports i and j between which t_{ij} is nominally greater than zero

1.3.13

isolated ports

two ports i and j between which t_{ij} is nominally zero, and a_{ij} is nominally infinite

1.3.14**directivity****near-end crosstalk**

value of a_{ij} between two isolated ports

1.3.15**excess loss**

total power lost in a non-wavelength-selective branching device when an optical signal is launched into port i , defined as

$$EL_i = -10 \log \sum_j t_{ij}$$

where the summation is performed only over those values j for which i and j are conducting ports. For a non-wavelength-selective branching device with N input ports, there is an array of N values of excess loss, one for each input port i .

1.3.16**uniformity**

logarithmic transfer matrix of a branching device may contain a specified set of coefficients which are nominally finite and equal. In this case, the range of these coefficients a_{ij} , expressed in decibels, is termed the uniformity of the branching device

1.3.17**coupling ratio**

for a given input port i , the ratio of light at a given output port k to the total light from all output ports and defined as

$$CR_{ik} = t_{ik} / \sum_j t_{ij}$$

where j represents the operational output ports.

1.3.18**symmetric non-wavelength-selective branching device**

device whose transfer matrix is diagonally symmetric, i.e. where for all i and j , t_{ij} and t_{ji} are nominally equal

1.3.19**asymmetric non-wavelength-selective branching device**

device whose transfer matrix is diagonally asymmetric, i.e. where there exists at least one i and j for which t_{ij} and t_{ji} are nominally unequal

1.3.20**operating wavelength**

nominal wavelength λ , at which a passive component is designed to operate with the specified performance

1.3.21**operating wavelength range****bandpass**

specified range of wavelengths from $\lambda_{i \min}$ to $\lambda_{i \max}$ about a nominal operating wavelength λ_i , within which a passive component is designed to operate with the specified performance

NOTE For a non-wavelength-selective branching device with more than one operating wavelength, the corresponding wavelength ranges are not necessarily equal.